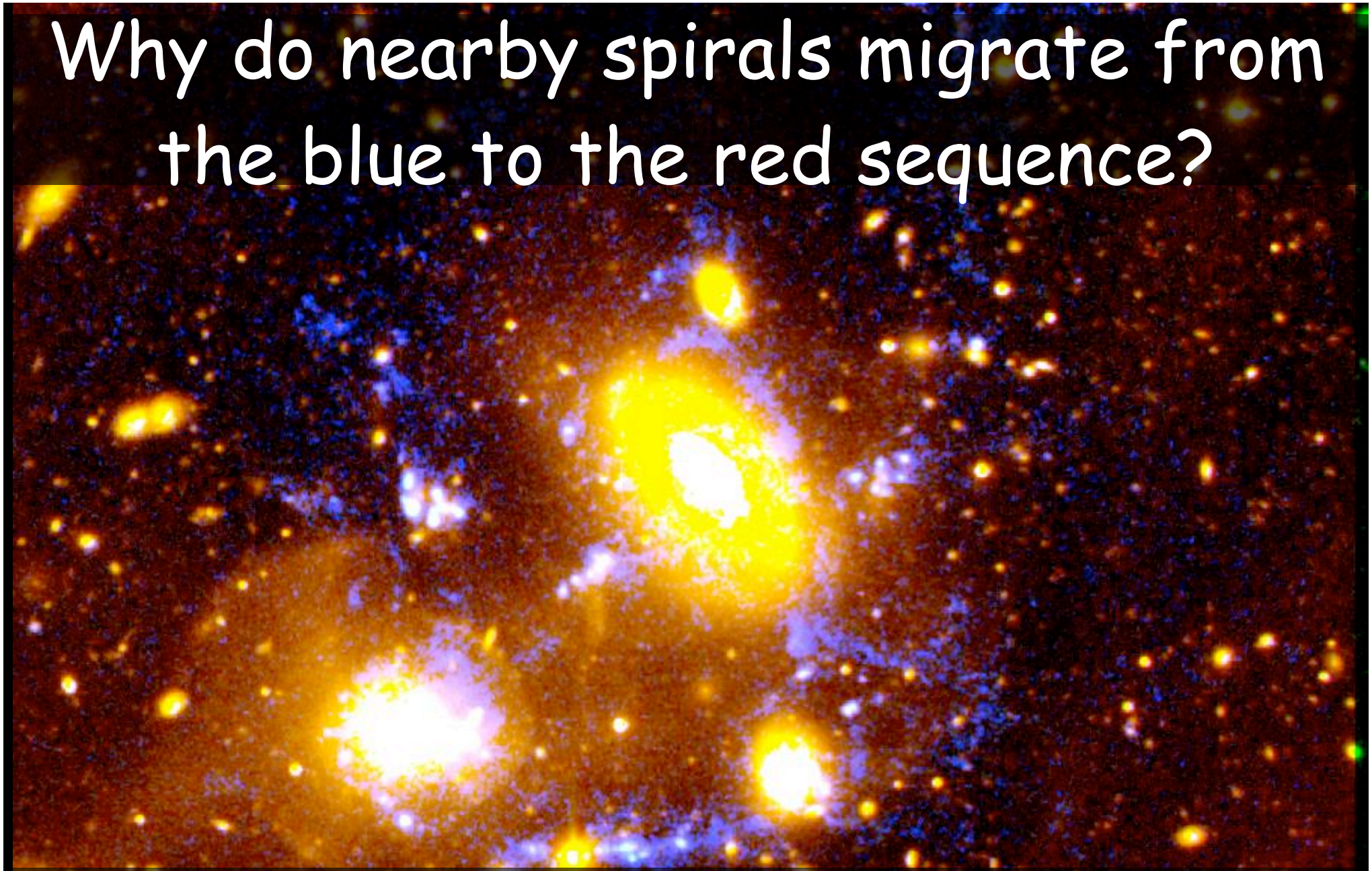
Why do nearby spirals migrate from the blue to the red sequence?



Luca Cortese (Cardiff University)

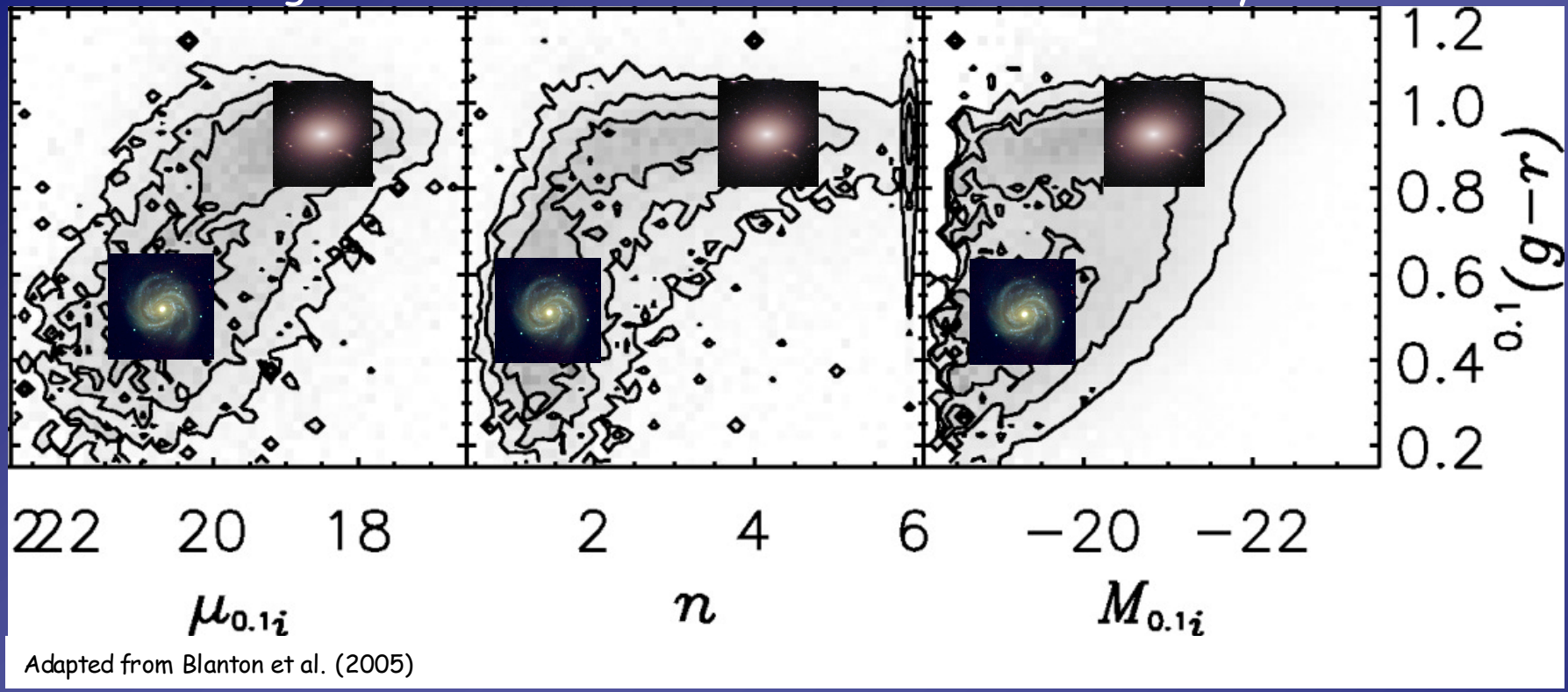
& Thomas Hughes (Ph.D. student in Cardiff)

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

CARDIFF UNIVERSITY
PRIFYSGOL CAERDYDD

Galaxies: a bimodal population

Surface Brightness | Sersic Index | Luminosity



Adapted from Blanton et al. (2005)

Late Types

Exponential SB profile

Star formation activity

Young stars

Gas rich

Early Types

Bulge dominated

No star formation activity

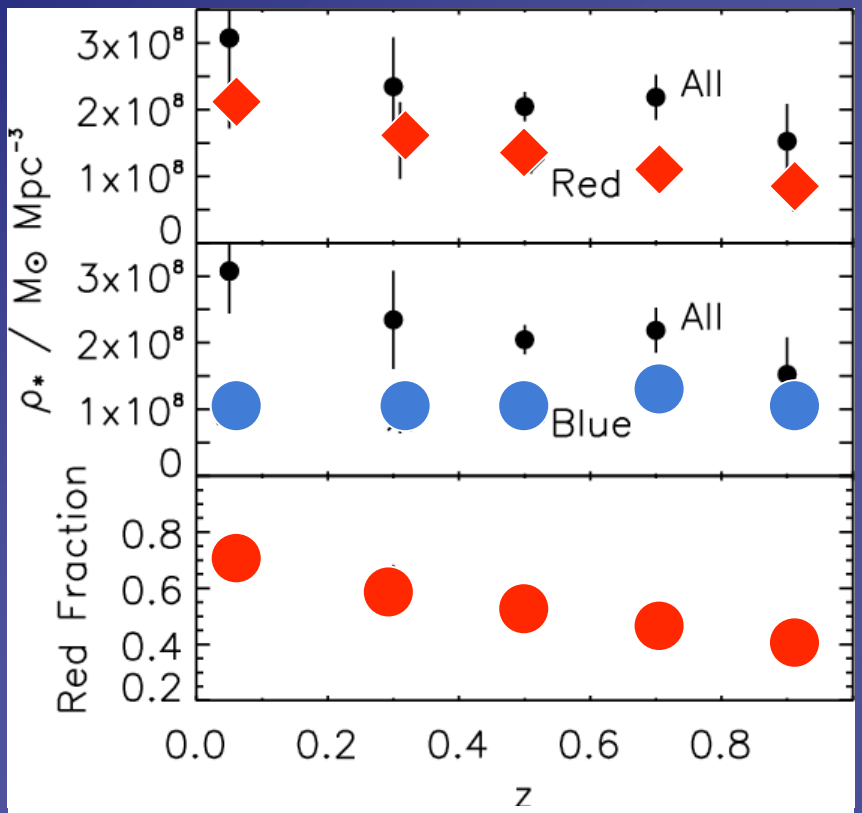
Old stellar populations

Gas poor

The evolution of the colour-mass diagram

From redshift z~1 until now:

(e.g. Bell et al. 2004,2007; Blanton 2007; Borch et al. 2006; Faber et al. 2007)



Adapted from Borch et al. (2006)

Red Sequence (no or low SF):

Stellar mass up by a factor 2 (or more).

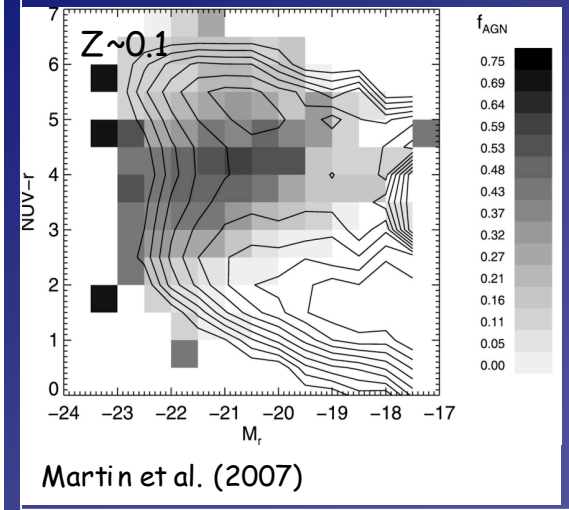
Blue Sequence (SF):

Stellar mass ~constant.

Galaxies form stars in the blue sequence, then migrate to the red sequence.

Why do galaxies leave the blue sequence?

AGN feedback?

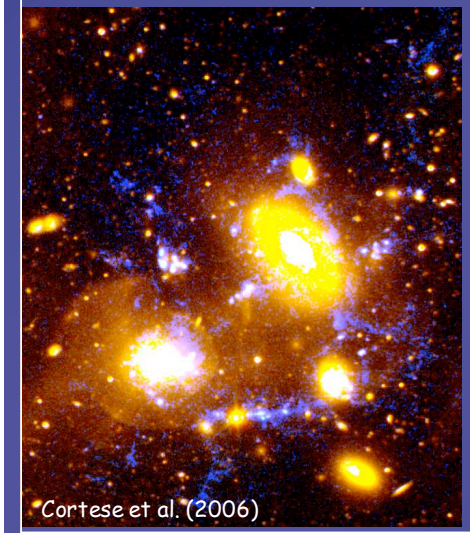


Martin et al. (2007)

AGN fraction higher in the "transition" region between the blue and red sequence.

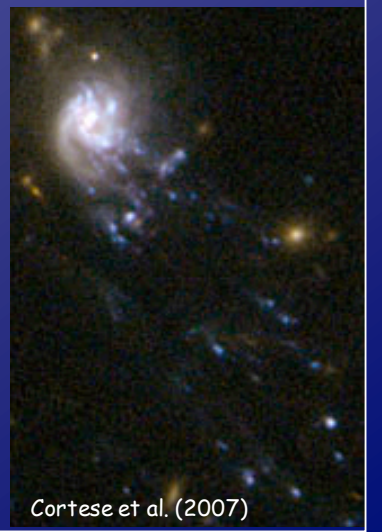
Cold gas is heated and SF is stopped.

Environmental effects?


Cortese et al. (2006)

Early types/Quiescent/Gas poor objects mainly found in high density environments.

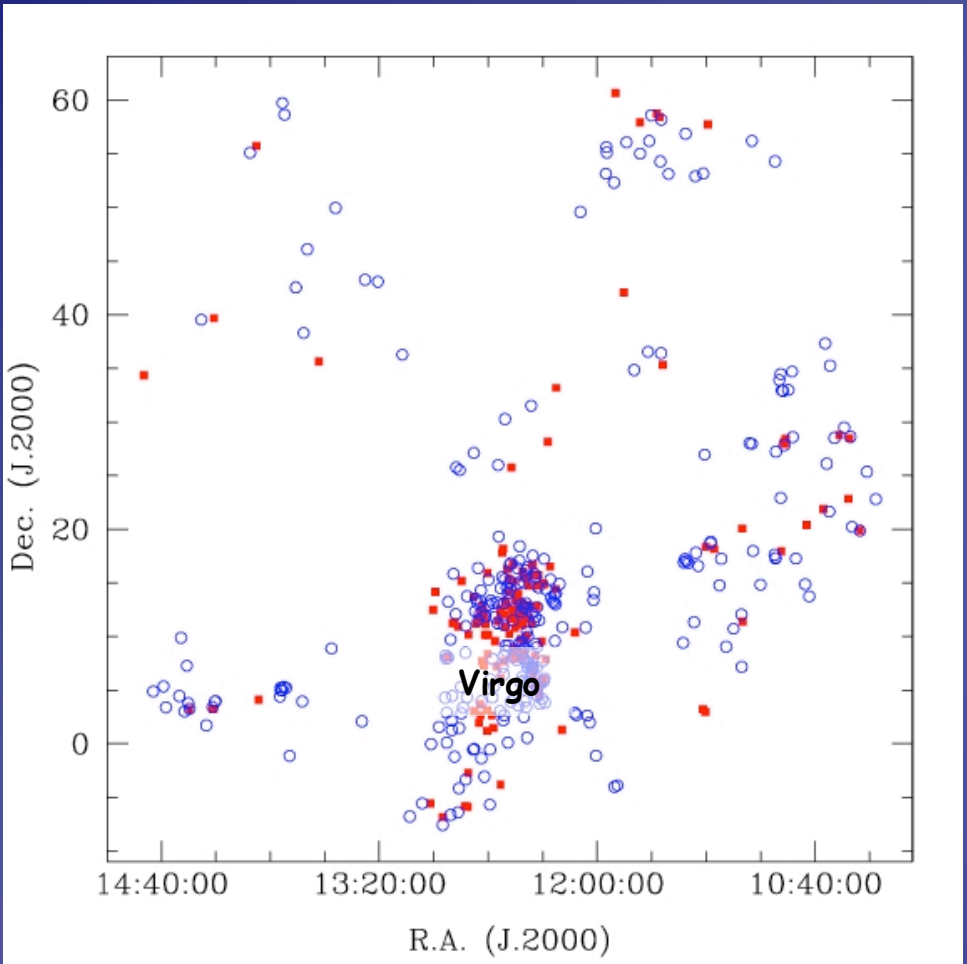
Gas is removed and SF is stopped.


Cortese et al. (2007)

A local volume limited complete sample

The Herschel Reference Survey

(Boselli et al., submitted)



- 15<D<25 Mpc
- K<12 (M_{star}>~10^9 $M_\odot$)
- b (Gal. lat.) > +55 deg.
- A(B) < 0.2 mag

- 454 galaxies
- ~5000 deg^2
- 171 E/S0/dE (130 in Virgo)
- 283 Late type (144 in Virgo)

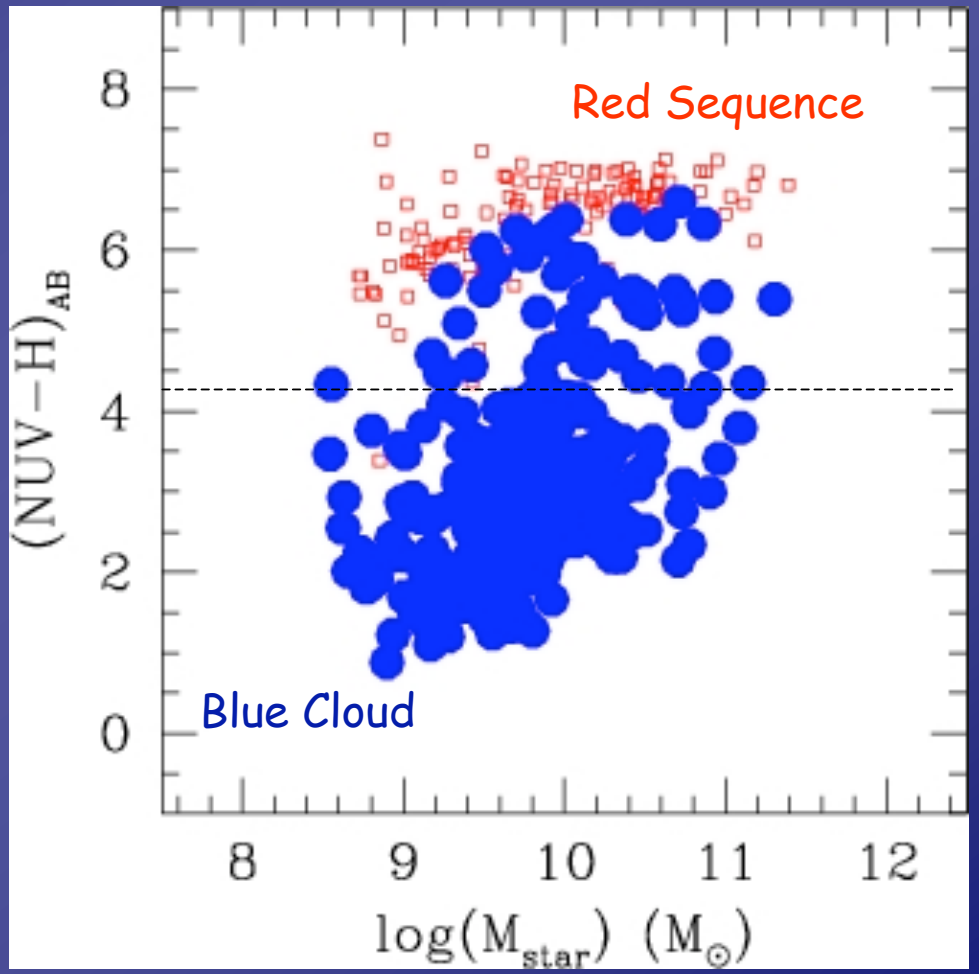
We combine for the first time UV-opt-NIR to HI single-dish observations

The local UV-NIR colour mass relation (I)

Morphology

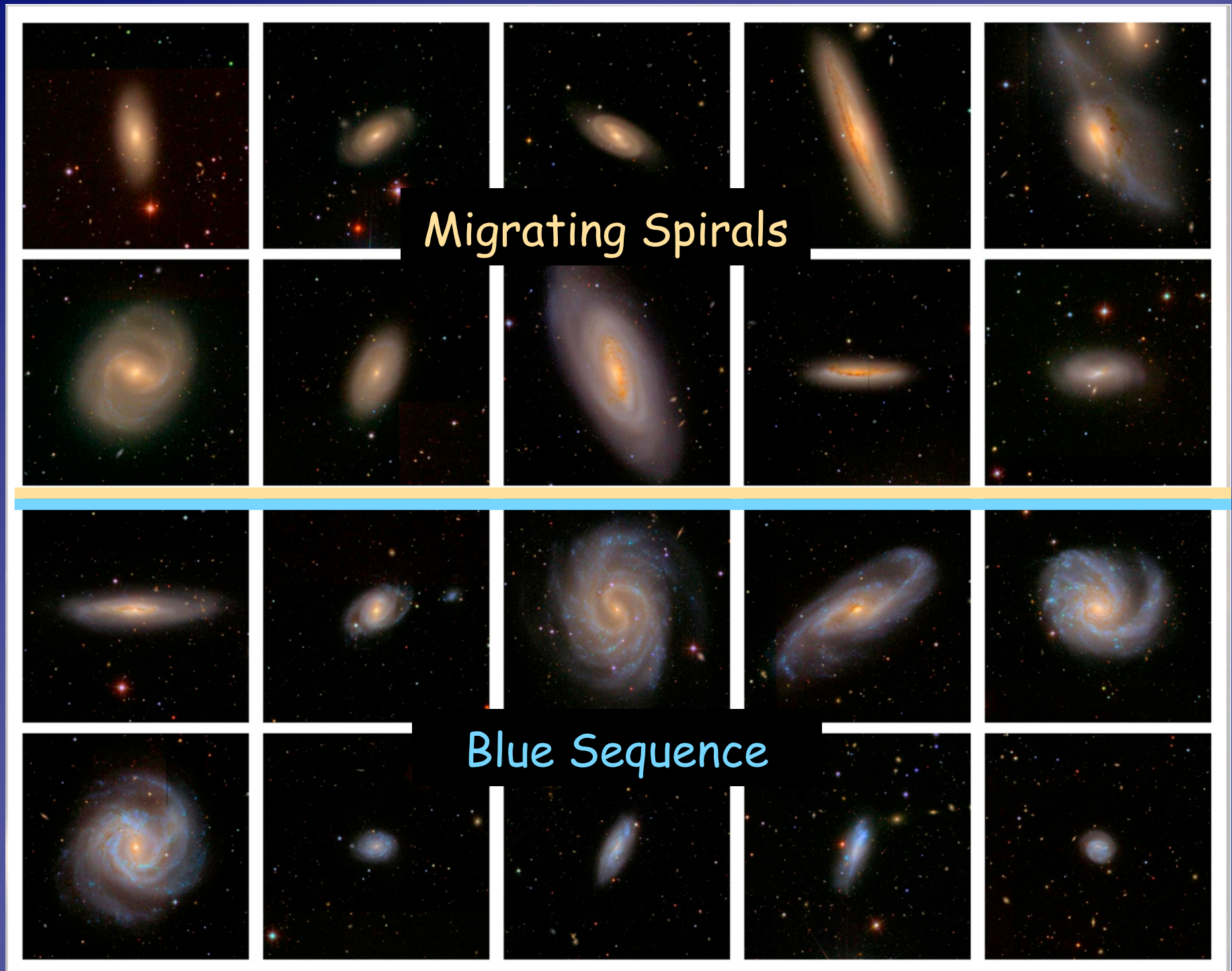
Red = E+S0

Blue = Sa and later



Early types are segregated in the red sequence.

The transition region is mainly populated by late types.


Migrating Spirals
Blue Sequence

The local UV-NIR colour mass relation (II)

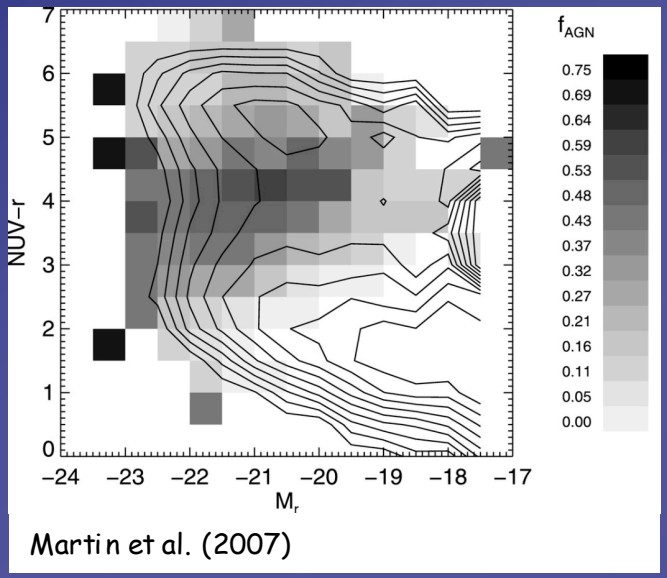
AGN activity in spirals

SDSS Nuclear opt. emission lines

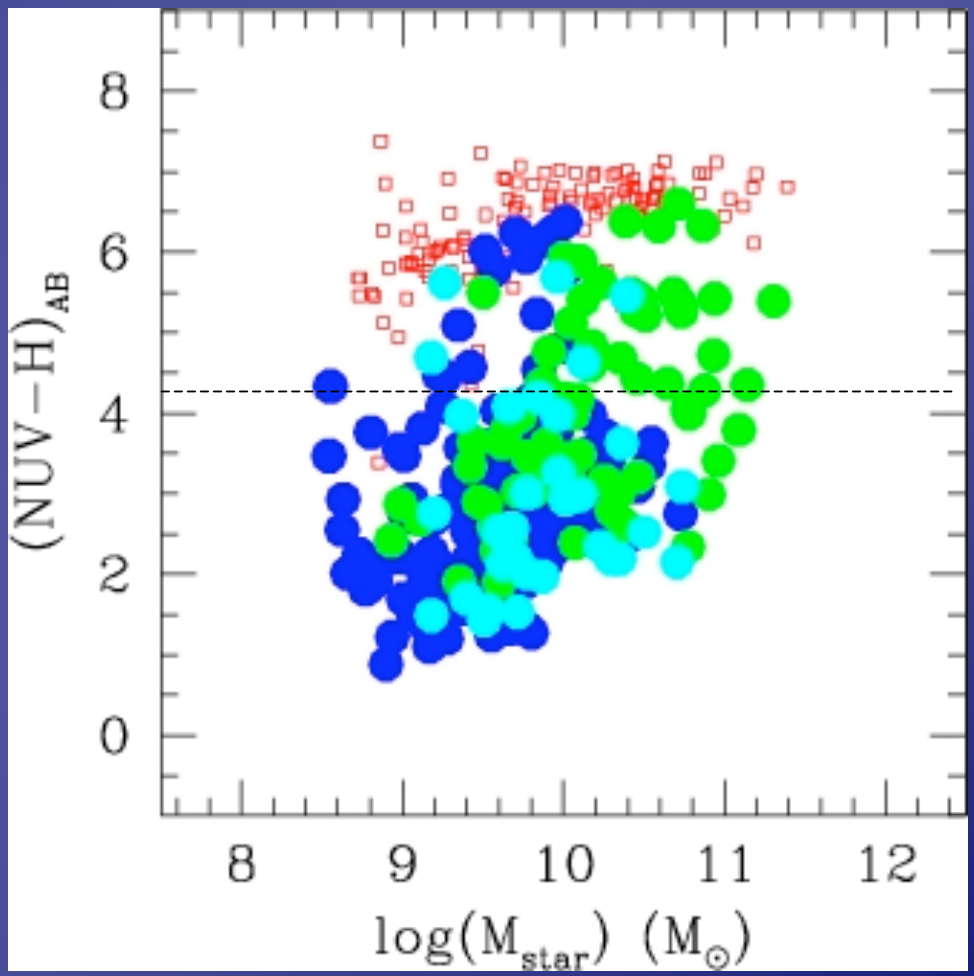
Blue = SF or No Nuclear Activity

Cyan = SF/AGN

Green = AGN (Seyfert+Liners)



Martin et al. (2007)



AGN host galaxies seem to peak in the transition region.

Hughes & Cortese 2009, submitted

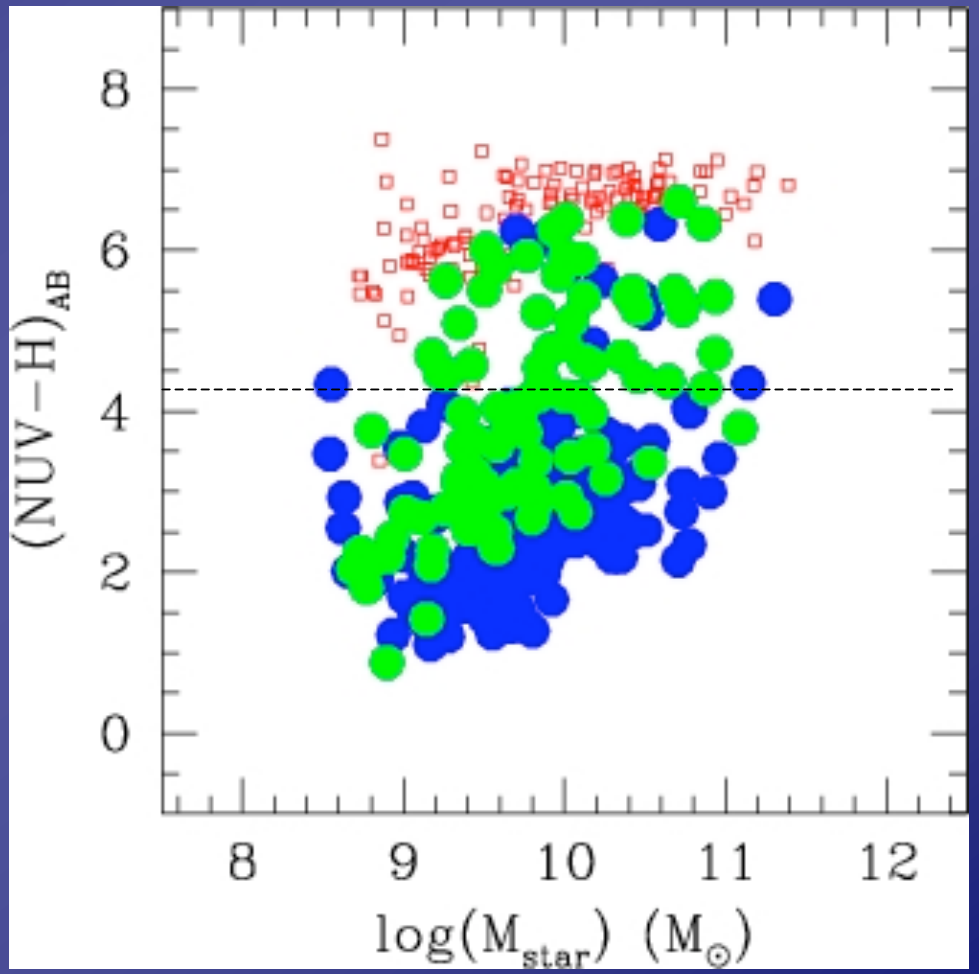
The local UV-NIR colour mass relation (III)

HI content in spirals

Single-dish HI 21cm obs.

Green = HI-def > 0.5

(lost >70% of its gas content)



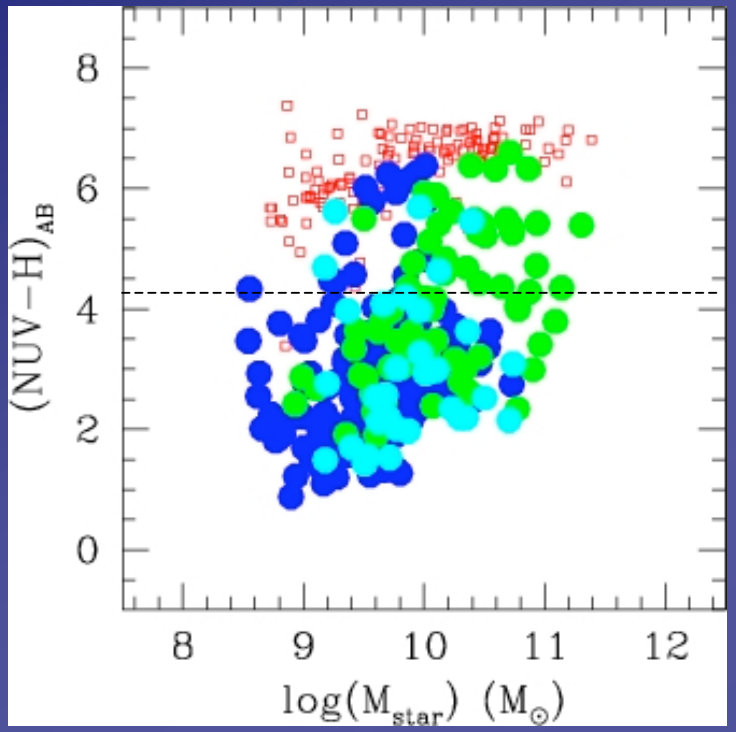
Transition galaxies are mostly HI deficient spirals.

Hughes & Cortese 2009, submitted

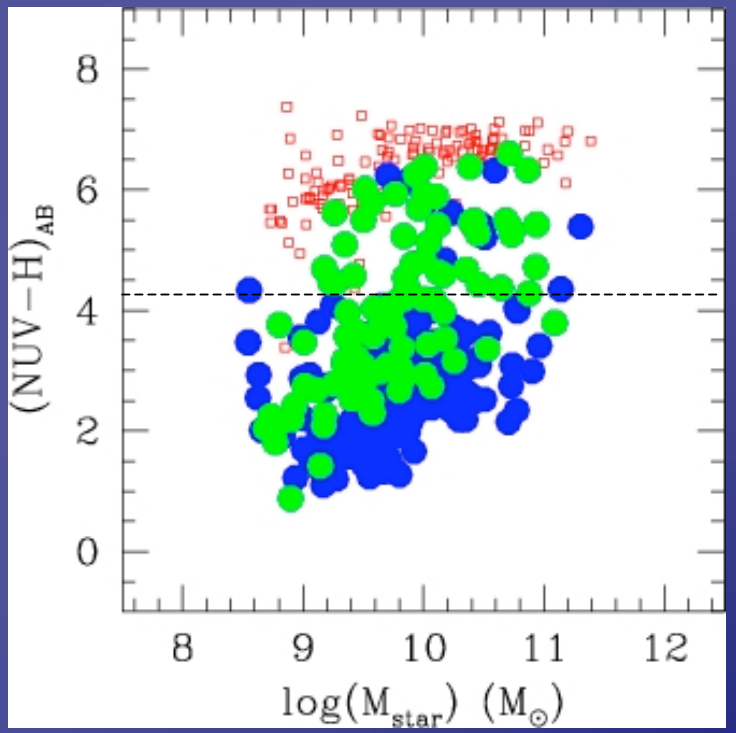
Migration driven by AGNs?

Is the HI deficiency caused by AGN feedback?

AGN



HI-deficiency



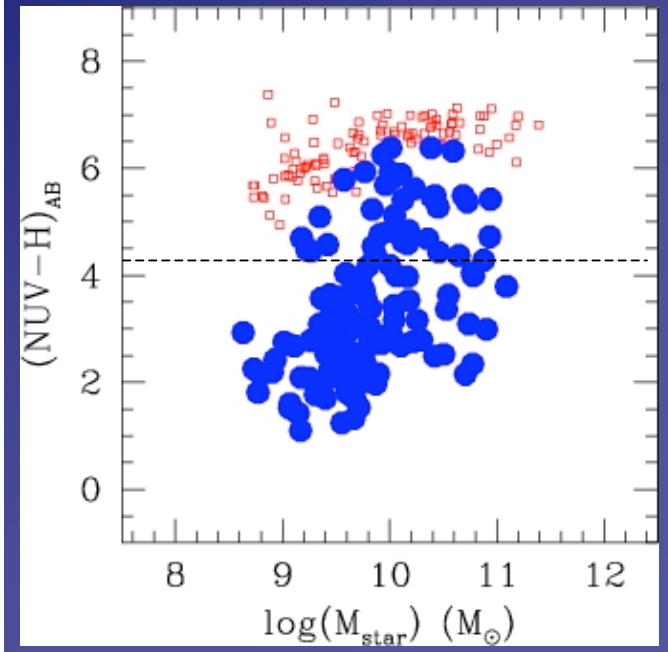
AGN segregated in high-mass galaxies

HI-deficiency usually due to environmental effects

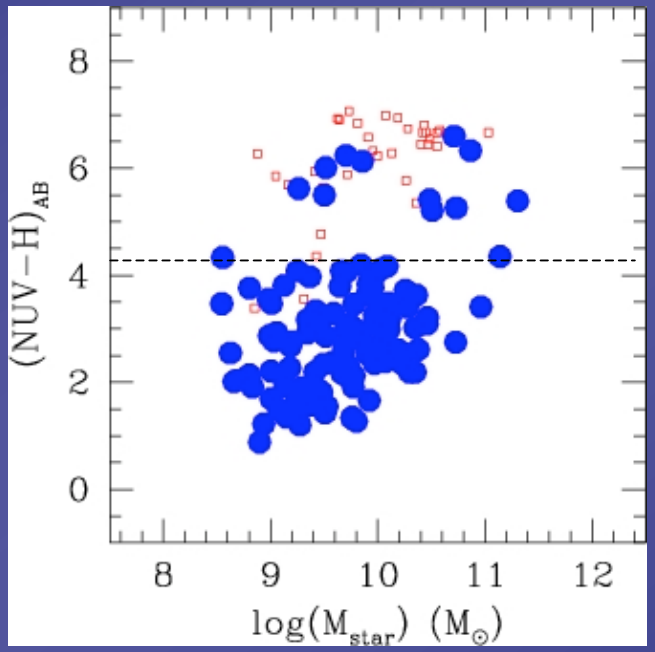
Hughes & Cortese 2009, submitted

Migrating spirals are mainly HI poor galaxies in high density environments

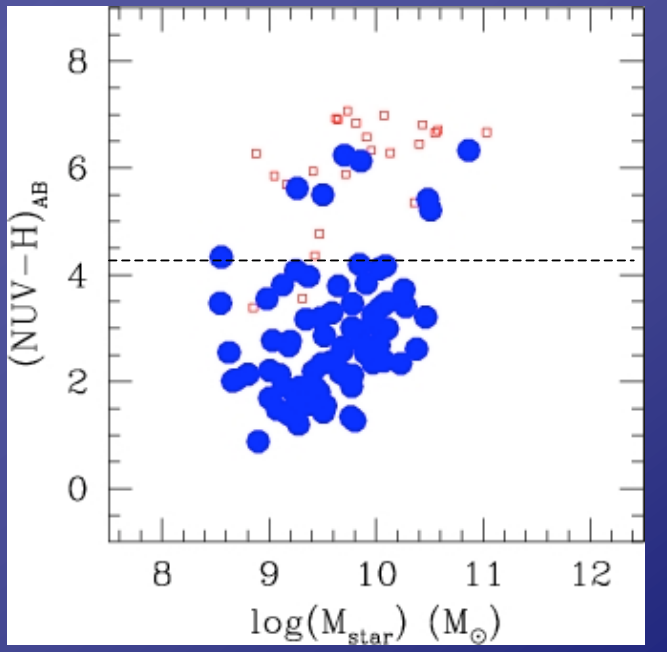
Virgo galaxies



Isolated+Group galaxies

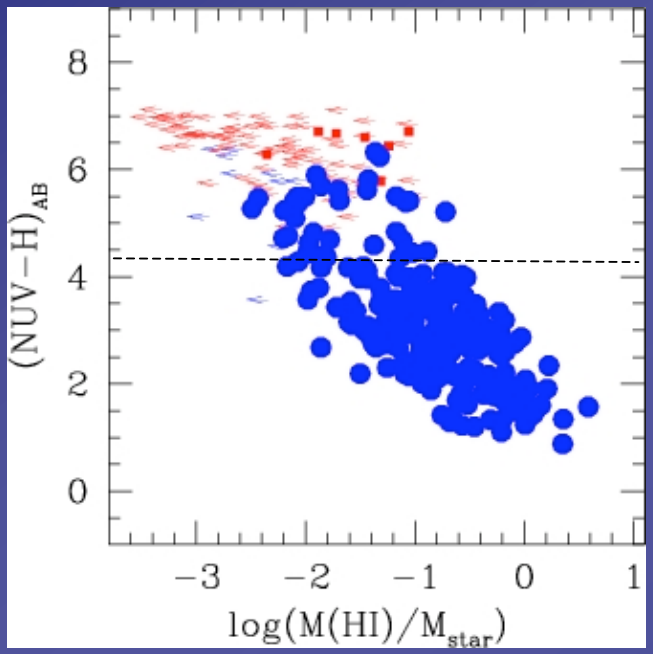


Isolated galaxies

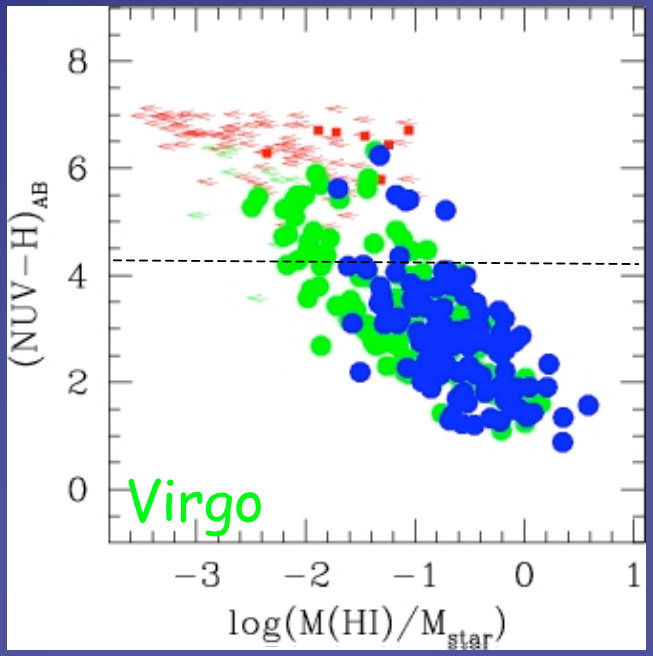


Hughes & Cortese 2009, submitted

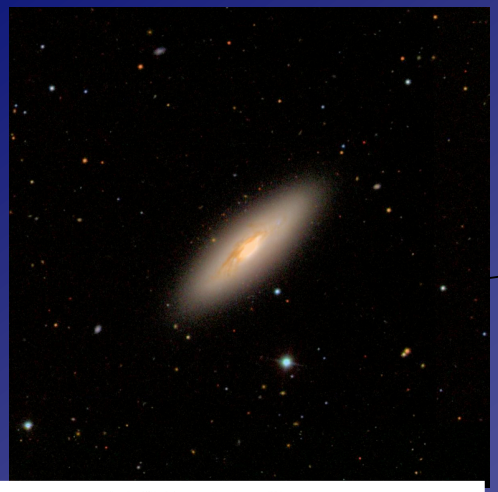
Red colour ⟶ Low gas-fraction

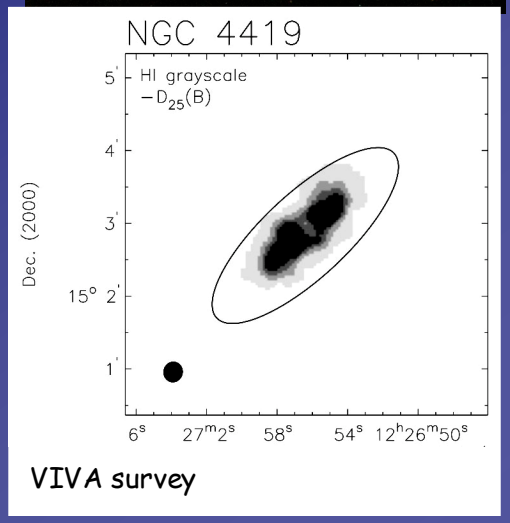


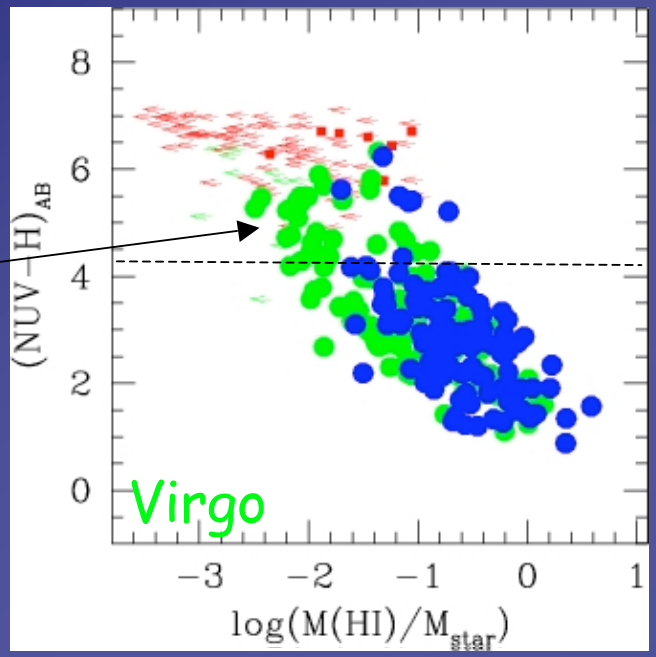
Red colour ⟶ Low gas-fraction



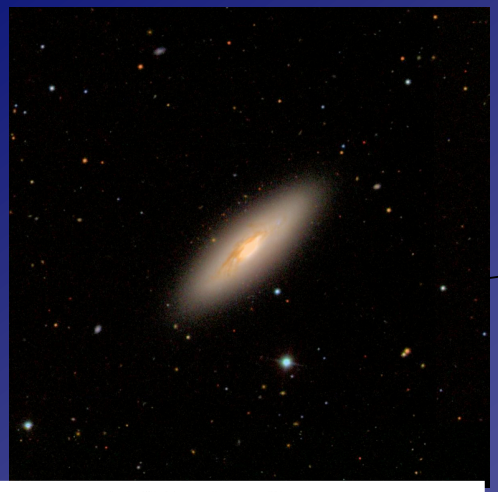
Red colour ⟶ Low gas-fraction

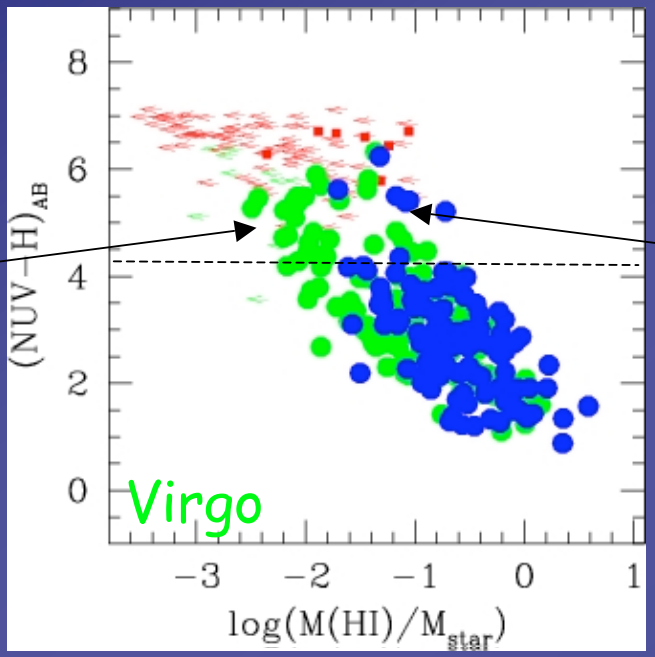


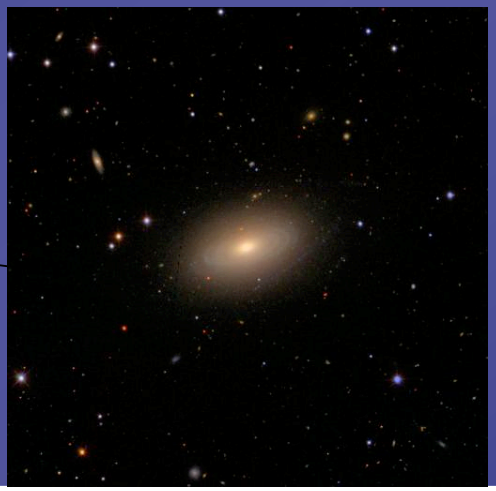


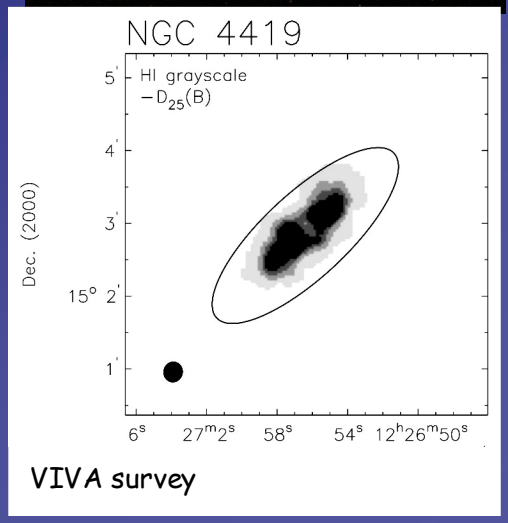


Red colour ⟶ Low gas-fraction



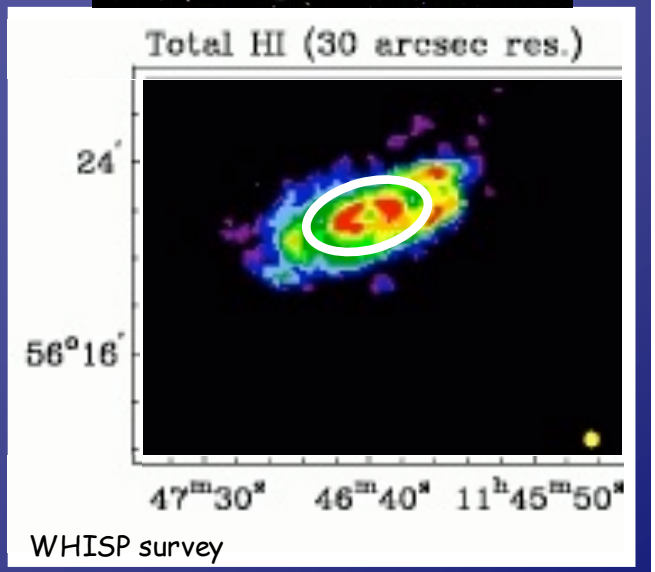






Field: migrating spirals higher Gas-fraction than in Virgo.

No clear HI truncation.



Different mechanisms at work? Are we witnessing accretion?

We need to know not only how much gas there is but also where it is!!

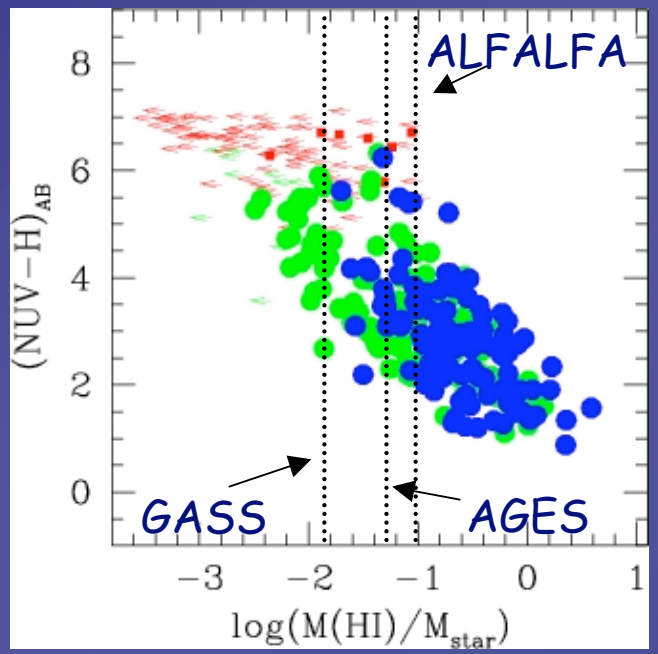
The present/future: EVLA

Current Arecibo surveys: a census of HI in local galaxies

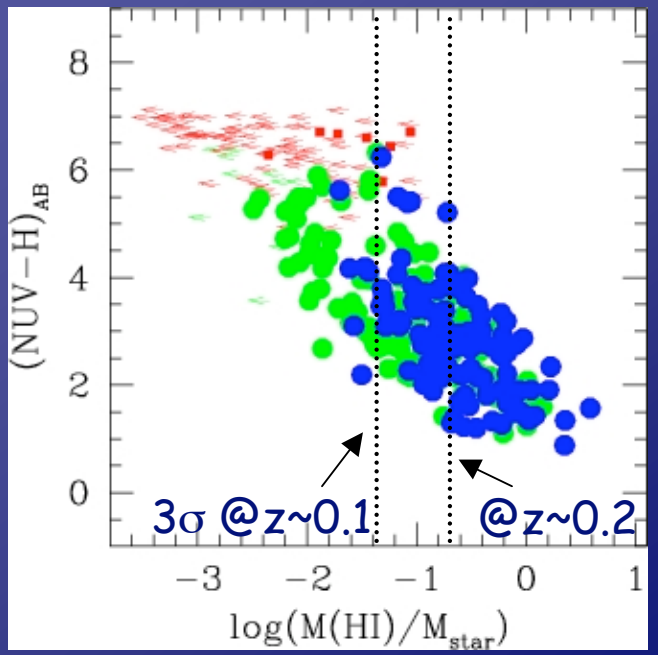
We also need to know where the HI is: Complement single-dish obs. with the VLA

Gradually move to higher redshift

M_{star}~10^{10} $M_\odot$ @ z~0.025 (Coma)



M_{star}~10^{10} $M_\odot$ - EVLA 36 hours



Summary

- The origin of the migration from the blue sequence

The majority of migrating spirals are HI deficient galaxies in high density environments.

- The peak of AGNs in the transition region

HI data crucial to show that it does not imply a physical link between quenching and AGN feedback.

The present/future: EVLA

- Local Universe: Quantify not only how much HI is there , but also where it is! Complement blind local Arecibo survey with VLA.

- Higher redshift (z~0.1-0.2): Investigate the role of environment in the quenching of the SF in clusters/groups.